AMENDMENTS TO THE SPECIFICATION:

Please replace the paragraph beginning at page 2, line 29, with the following rewritten paragraph:

a1

Processing the audio signal prior to modulation can ~~minimise~~ minimize the effects of coloration and distortion that result from the interaction of the ultrasonic wave with the non-linear medium. The processing typically comprises a double integration filter to compensate for coloration of the audio signal and a square root operation to compensate for the distortion of the audio signal.

Please replace the paragraph beginning at page 3, line 13, with the following rewritten paragraph:

a2

Figure 1, plot A shows the frequency spectrum of a white noise input signal constrained between 300 and 4000 Hz prior to modulation with an ultrasonic carrier signal. An example of the effects of self-demodulation and transducer conversion upon the input signal, using a typical transducer having a measured frequency response shown in ~~figure~~ Figure 2, is shown in ~~figure~~ Figure 1, plot B.

Please replace the paragraph beginning at page 4, line 8, with the following rewritten paragraph:

a3

This provides the advantage of enabling the effects of the demodulation process and the transducer conversion characteristics on the audio signal to be ~~minimised~~minimized. This can allow the size of the transducer to be reduced while retaining the performance of the transducer.

Please replace the paragraph beginning at page 4, line 16, with the following rewritten paragraph:

a4

Most preferably the processing means comprises a double integration filter and a square root operator. As the operator processes the audio signal non-linearly, the characteristics of the second filter are preferably derived empirically by tone adjustment for the required frequency range of the audio signal.

Please replace the paragraph beginning at page 4, line 29, with the following rewritten paragraph:

a5

Figure 1, plot B shows the frequency spectrum of ~~figure~~ Figure 1, plot A after self-demodulation without correction;

Please replace the paragraph beginning at page 6, line 6, with the following rewritten paragraph:

a6

Figure 4 shows the audio apparatus 2 which comprises a double integration filter 7, a transducer response filter 8, a DC up-shifter 9, an up-sampler 10, a square root operator II, a modulator 12, an ultrasonic signal source 13, a digital to ~~analogue~~ analog converter 14 and an ultrasonic transducer 15.

Please replace the paragraph beginning at page 6, line 24, with the following rewritten paragraph:

a7

The transducer response filter 8 corrects for characteristics of the ultrasonic transducer 15, as described in detail below. The transducer response filter 8 provides the corrected signal 25 to DC up-shifter 9.

Please replace the paragraph beginning at page 6, line 27, with the following rewritten paragraph:

a8

The DC up-shifter 9 re-scales the data and shifts the voltage of the corrected digital signal 25 so that all signal voltages are positive, thus ensuring the square root operation only has to work on positive values, thereby avoiding complex filtering.

Please replace the paragraph beginning at page 7, line 4, with the following rewritten paragraph:

a9

The DC up-shifted signal 26 is provided to up-sampler 10. The up-sampler 10 re-samples the 8 kHz signal at typically 120 kHz. The purpose of up-sampler 10 is to increase the frequency range of the signal in preparation for the square rooting of the signal. A consequence of square rooting the received signal is the creation of an infinite series of harmonics. For distortion to be eliminated all these harmonics must be reproduced. Therefore, to ensure harmonics above 4 kHz are reproduced, the signal is re-sampled at a higher frequency. Sample rates other than 120 kHz may be used dependant on the operating frequencies of the ultrasonic transducer. The re-sampled signal 27 is provided to the square root operator 11.

Please replace the paragraph beginning at page 7, line 21, with the following rewritten paragraph:

a10

The square rooted signal 28 is provided to modulator 12 for modulation with an ultrasonic signal 29 from ultrasonic signal source 13. To ~~minimise~~ minimize the risk of harm to humans or animals, the ultrasonic frequency should be higher than approximately 40kHz. Due to increased signal absorption by the air at higher frequencies the upper highest feasible frequency limit is typically of the order of 200kHz.

Please replace the paragraph beginning at page 7, line 28, with the following rewritten paragraph:

a11

The digital modulated ultrasonic signal 30 is provided to digital to ~~analogue~~ analog converter 14 for converting the digital signal 30 to a representative ~~analogue~~ analog signal. The ~~analogue~~ analog modulated ultrasonic signal 31 is provided to ultrasonic transducer 15. Transducer 15 radiates the modulated ultrasonic signal as an inaudible ultrasonic pressure wave.

Please replace the paragraph beginning at page 8, line 4, with the following rewritten paragraph:

a12

To obtain the required ultrasonic pressure levels required for self-demodulation to occur, the transducer 15 will typically be chosen to have its resonance frequency at the frequency of the ultrasonic carrier signal 29.

Please replace the paragraph beginning at page 8, line 8, with the following rewritten paragraph:

a13

For a 40 kHz ultrasonic signal a suitable transducer is the MuRata MA4OB8S. This transducer has a frequency response as shown in ~~figure~~ Figure 2, which has a narrow resonance band at 40 kHz. To obtain the required power levels a plurality of transducers will typically be required, for example 19 transducers will provide 55 dB's of audio speech signal.

Please replace the paragraph beginning at page 8, line 14, with the following rewritten paragraph:

a14

As the square root operator 11 is non-linear, it is not possible for the 15 transducer response filter 8 to have a single optimum filtering characteristic for all frequencies. Therefore, the transducer response filter 8 is determined empirically for a required frequency range. For example, if the resultant spectra of the self-demodulated signal shows a gradual power drop from 300 Hz to 4 kHz after correction for self-demodulation, the transducer response filter 8 is selected to boost the signal over this frequency range. The characteristics of the transducer response filter are therefore, typically, the inverse response of the resultant spectra of the self-demodulated signal. The transducer response filter is designed typically using a recursive filter design package, for example the Yule-Walk package, which models the transducer response filter characteristics using the inverse of the self-demodulated signal.

Please replace the paragraph beginning at page 9, line 4, with the following rewritten paragraph:

Figure 5, plot A shows the transducer conversion effect upon the input signal shown in ~~figure~~ Figure 1, plot A. Figure 5, plot B shows the corrected spectrum using a transducer response filter 8 empirically derived using ~~figure~~ Figure 5, plot A for determining the effect of the transducer conversion. For different frequency and modulation depths the square root non-linear operator 11 will vary the effects of the transducer conversion and accordingly different frequency and modulation depths will require the transducer response filter 8 to be modified empirically as described above.

a15

Please replace the paragraph beginning at page 9, line 15, with the following rewritten paragraph:

The present invention may include any novel feature or combination of features disclosed herein either explicitly or implicitly or any ~~generalisation~~ generalization thereof irrespective of whether or not it relates to the presently claimed invention or mitigates any or all of the problems addressed. In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention. The applicant hereby gives notice that new claims may be formulated to such features during prosecution of this application or of any such further application derived therefrom. For example, it will be appreciated that an ~~analogue~~ analog audio signal can be processed and

a16

modulated with an ultrasonic carrier signal, also that the pre-processing filters and/or operator can be used to process the audio signal after modulation of the audio signal.

a16 cont

Please replace the Abstract on page 12, with the following rewritten Abstract:

a17

An audio ~~Audio~~ apparatus comprising a modulator 12 for modulating a first ultrasonic signal 29 with an audio signal to provide a second ultrasonic signal 30; a transducer 15 for converting the second ultrasonic signal 30 into an ultrasonic pressure wave for transmission into a non-linear medium to allow demodulation of the ultrasonic pressure wave and thereby generate an audio pressure wave representative of the audio signal 29, processing means 11 for modifying the audio signal to compensate for the demodulating properties of the non-linear medium; and means 8 for modifying the audio signal to compensate for the conversion characteristics of the transducer 15.